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SOME OBSERVATIONS

ON

THE MIGRATION OF BIRDS.

BY

THE LATE EDWARD JENNER,

M.D. F.R.S.

WITH AN

INTRODUCTORY LETTER TO SIR HUMPHRY DAVY, BART.

BY

THE REV. G. C. JENNER.

FROM THE

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SOME

OBSERVATIONS ON THE MIGRATION OF BIRDS.

Read before the ROYAL SOCIETY, *November* 27, 1823.

IT had long been the intention of my late revered Uncle, Dr. JENNER, to lay the accompanying observations on the Migration of Birds, before the Royal Society, as well from inclination, as to redeem a pledge he had given some years ago to that learned Body; but which he was unable to accomplish, in consequence of his extensive correspondence with almost every part of the globe on the interesting subject of Vaccination, which occupied nearly the whole of the time his more immediate professional avocations would allow him to bestow on other objects.

It was my peculiar happiness to accompany Dr. JENNER in most of his investigations of the phenomena of migration; and the Paper I have now the honour of presenting, was left in my hands at the time of his decease.

Had it pleased Providence to have spared him a little longer, he might, probably, have corrected some inaccuracies in the style and order of his Paper, that may now, perhaps,

appear conspicuous to the reader, but which I did not conceive myself justified in attempting.

I have the honour to be, Sir,

Your most obedient humble servant,

G. C. JENNER.

Stone, near Berkeley,
May 29, 1823.

To Sir HUMPHRY DAVY, Bart.
President of the Royal Society,
&c. &c. &c.

I.

IT is not my intention, in the following pages, to give a general history of the migration of birds. The order in which they appear and disappear, their respective habits, and many other observations, have been given with considerable accuracy by several naturalists, who have paid attention to this very curious subject. It is with a view of representing some facts, hitherto unnoticed, chiefly with respect to the *cause*, which excites the bird, at certain seasons of the year, to quit one country for another, that I communicate the following pages to this learned body.

But before I proceed to state my observations on this head, it may be necessary to adduce some arguments first, in support of the reality of migration, the fact itself not being generally admitted; and, secondly, against the hypothesis of a state of torpor, or what has been called the hibernating system.

In the first place, the ability of birds to take immensely long flights, is proved by the observations of almost every person conversant with the seas. To the many instances already recorded, I shall add the following:

My late nephew, Lieutenant JENNER, on his passage to

Newfoundland, saw, on the 20th of May, the hobby hawk. It came on board, and was secured. The day following a swallow came on board. At this time the ship was steering a course direct for that island, and was not within the distance of an hundred leagues of any land. His brother, the Reverend G. C. JENNER, in crossing the Atlantic, observed an owl (of what species he could not precisely ascertain, but he believes it to be the common brown owl) gliding over the ocean with as much apparent ease as if it had been seeking for a mouse among its native fields.* Wild geese have frequently been shot in Newfoundland, whose crops were plentifully stored with maize, or indian corn; consequently, these birds must have taken a pretty bold flight in a short space of time, as no corn of this kind is cultivated within a vast distance of that island. These, however, I do not consider as migrations of any farther consequence, than just to show the powers of the wing.

My ingenious friend and neighbour, the late Reverend NATHANIEL THORNBURY, who had occasionally visited Holland, informed me, that the pigeons about the Hague make a daily marauding excursions, at certain seasons, to the opposite shore of Norfolk, to feed on vetches, a distance of forty leagues. Now, may not this be almost considered as daring a flight as that of the bird which crosses the Atlantic? For it

* Mr. JENNER informs me, that in subsequent voyages, he has taken, in the Atlantic, several hundred miles from land, the nuthatch, hoopoe, and snipe; and has often seen small birds of the linnet kind. Of the latter, a large flock came on board, perched on the rigging, appeared very lively, and after adjusting their plumage, and chirping in concert for a few minutes, took their flight in a direction for the Azores.

is not at all probable that the shores of this country can be visible to the flock when they set out.

Again. Is there not something as extraordinary in the pigeon, which can, in a few hours, find out its home, though taken away in a box and totally excluded from the light, to the distance of two hundred miles, as in that bird which quits one shore to seek another, whatever may be the extent of intervening seas? The fact seems to be, that we, the *little lords of the creation*, are too prone to measure the sentient principle in animals by the scale of our own ideas, and thus, unwillingly, allow them to possess faculties which may surpass our own, though peculiarly appropriate to their respective natures; but a little reflection must compel us to confess, that they are endowed with discriminating powers totally unknown to, and for ever unattainable by man. I have no objection to admit the possibility that birds may be overtaken by the cold of winter, and thus be thrown into the situation of other animals which remain torpid at that season; though I must own I never witnessed the fact, nor could I ever obtain evidence on the subject that was to me satisfactory: but as it has been often asserted, may I be allowed to suppose, that some deception might have been practised with the design of misleading those to whom it might seem to have appeared obvious? For far be it from me to insinuate that the subject has been wilfully misrepresented by those naturalists, who have stated it as a fact. Yet how careful should we be in the investigation of all subjects in natural history, which may captivate, by their apparent novelty!

If birds crept into holes and crevices to hibernate, would they not, like quadrupeds, creep out again in a languid state,

their fat all absorbed, and their bodies emaciated? We see this fact exemplified in the hedge-hog, one of the most remarkable of our hibernating animals, which retires to its hut at the approach of winter, with vast stores of fat placed in every situation where nature could find room for it. This fat is its only source of nutrition for the winter, which, by the time the sun rouses it to fresh life and activity, is exhausted, and the animal comes forth thin and emaciated. But the case with birds is extremely different. If, on the first day of its appearance, a martin, a swift, or a redstart be examined, it will be found as plump and fleshy as at any season during its stay; it appears also as strong on the wing, and as full of activity at that period as at any other during its abode with us. How the cuckoo, that disappears at so early and so hot a season as the first week in July, can become torpid, is beyond the power of conception.

The apparent incapability of the landrail to perform the task of migration, has often been so strongly adduced as a presumptive argument in favour of the hibernating system, that those who do not admit that of migration, were it to remain unnoticed, might urge it as an objection. It must be admitted, that a superficial examination of the habits of this bird, tends to favour the supposition of its incapacity for so great an exploit, as it often rises from the ground like an half animated lump, and seems, with difficulty, to take a flight of a hundred yards; but let us remark its powers when seriously alarmed. Should it be forced upon the wing by any extraordinary cause, by the pursuit of a hawk, for example, the velocity of its flight, and the rapidity of its evolutions to avoid the common enemy of its race, will at once appear.

This is no very rare exhibition. Necessity here, as in migration, becomes the parent of exertion, which when thus called forth, cannot be shown in a much greater degree by any of the feathered tribe. The moor-hen (which winters with us) gives another instance of what a bird, which appears so much to want activity in its ordinary flights, is capable of performing when exertion is actually required. When pursued by a hawk, and self preservation calls up all its powers, it may be seen to rush up into the air with amazing velocity, almost as high as the eye can reach, then darting down with an equal pace, it often, by such rapid manœuvres, escapes the destructive talons of its swift pursuer.

It is a remarkable fact that the swallow tribe, and probably many other birds which absent themselves at stated periods, should return annually to the same spot to build their nests. The swift, which for nine months has some distant region to roam in, was selected for the purpose of an experiment to ascertain this with precision. At a farm-house in this neighbourhood I procured several swifts, and by taking off two claws from the foot of twelve, I fixed upon them an indelible mark. The year following their nesting places were examined in an evening when they had retired to roost, and there I found several of the marked birds. The second and third year a similar search was made, and did not fail to produce some of those which were marked. I now ceased to make an annual search, but at the expiration of seven years, a cat was seen to bring a bird into the farmer's kitchen, and this also proved to be one of those marked for the experiment.

That the bird, when the stimulus for migration is given,

with the choice before it of almost any part of Europe for its annual excursion, should so uniformly not only revisit this island, but even select the same spot for its breeding place, is certainly a wonderful occurrence. But if birds were not instinctively directed to return to their old haunts, should we not find them over crowding some situations, while others would be left desolate? And would not this be the case if the search of food was the object of their migration? However it may be admissible, in one point of view, to consider the bird in its state of migration from this country, as a nearer neighbour than at first might be conceived, if we may be allowed to consider distance, or space, in the instance before us, as governed by the power of progressive motion, of what consequence is it to the swift, which, to use the animated expression of Mr. WHITE, " dashes through the air with the " inconceivable swiftness of a meteor," whether he comes to us from some neighbouring country, or the shores of Africa? The wonder excited by the return of these birds again to their old nesting places, would at once cease, if we could believe what has been asserted by some naturalists, and gained credit with many, namely, that at the time they disappear from us, they submerse themselves in ponds and rivers, and in this situation become torpid. If this idea had not been encouraged and supported by some new hypothesis, I should hardly have thought it necessary to have taken any serious notice of it; but as the matter now stands, I will just state my opinion, why I think it impossible for any birds to be disposed of in this way.

Permit me first to call to your recollection the season of the year at which many of these birds disappear. It happens

when they feel no cold blast to benumb them, and when the common food with which they are supported, is distributed through the air in the greatest abundance. At such a time, what can be the inducement to them and their young ones, which have but just began to enjoy the motion of their wings, and play among the sun-beams, to take this dreary plunge? And how is the office of respiration to be performed during the nine months watery residence? The structure of the lungs of birds, differs not essentially from that of quadrupeds, and therefore all communication with the atmosphere being cut off from the first moment of submersion, the possibility of a bird living nine months, or indeed as many minutes under water, appears to be totally irreconcilable with the nature of their structure. I have taken a swift about the 10th of August, which may be considered as the eve of its departure, and plunged it into water; but like the generality of animals which respire atmospheric air, it was dead in two minutes.

The late Doctor BEDDOES has thrown out a supposition, that by frequent immersion in water, the association between the movements of the heart and lungs might perhaps be destroyed, and that an animal might be inured to live commodiously for any time under water. As this will probably give new vigour to the languid system of the advocates for the submersion of birds, I think it incumbent upon me to mention it.

Though we frequently see the swallow and the martin sprinkle and splash themselves as they glide over the surfaces of ponds and rivers, yet we never see them dip under for a single moment; indeed a few plunges would so moisten

their wings as to prevent their flying, and we should see them occasionally in this disordered state fluttering on the shore. If they went to the sea side, and got beyond the reach of the eye to inure themselves to this element, how could they return, divested as they must be either of the means of swimming or flying? Whoever has observed the common tame duck driven to the necessity of repeatedly diving from the pursuit of a water-dog, must have noticed how exhausted it rises to the surface of the water after a short period of submersion, and how incapable it is of flying, in consequence of the soaking of its wings. The same may be said of birds more in the habit of diving, the grebes and divers. When entangled in a net they soon perish, or when they happen to dive under ice that may chance to overspread a pond; no uncommon place of resort for some of the smaller species of grebes.

I have always been much attached to that faithful animal, the Newfoundland dog, and have often procured from that country those dogs that had been much accustomed to diving, and which had been kept to the practice; yet I never observed that any of them attained by habit the power of remaining under water longer than thirty seconds, and even then, on rising to the surface, they appeared confused. Negroes and other men who have been employed in seeking among sunken rocks the hidden treasures of the deep, are said to have acquired a habit of remaining some minutes under water, but the time was probably measured by a rude guess, and not by a stop watch.

Having thus called the attention of the Society to such statements as give support to the fact of migration, and

having also endeavoured to controvert the notion of an hibernating system, I beg to draw their attention to what I conceive to be the true *cause* of migration.

At the coming on of spring we observe our more domestic birds, those that approach our houses, and are most familiar to us, assuming new habits. The voice, gesticulation, and the attachment which the male begins to show to the female, plainly indicate some new agency acting upon the constitution.* This newly excited influence, which so conspicuously alters the habits of our birds at home, is, at the same time, exerting itself abroad upon those which are destined to resort hither. *It is the preparation which nature is making for the production of an offspring by a new arrangement in the structure of the sexual organs, (viz.) the enlargement of the testes in the male, and the ovaria in the female.*

No sooner is the impulse arising from this change sufficiently felt, than the birds are directed to seek a country where they can for a while be better accommodated with succours for their infant brood, than in that from which they depart.†

* The Rook, among many others, exhibits a familiar instance of the change of voice.

† Birds of the same species that are commonly stationary in this island throughout the year (I say *commonly*, for all, I believe, occasionally migrate), are migrators in other countries. The adult bird might, perhaps, find a subsistence for itself in the country it quits during the incubating season, but the nestling is probably the object nature chiefly holds in view, both with respect to food, and to the temperature of the air in which it is first to feel existence. The one may be unfit or too scanty, and the other too hot or too cold. It is wonderful to see with what peculiar care the parent birds select the food for their young until they are four or five days old. For the most part it is purely animal, but not an atom even of that is suffered to go into the nestling's stomach, that is not perfectly adapted to the tender state of

It is not at the commencement of this enlargement, nor until it is considerably advanced, that the birds are prompted to migrate; and this is very wisely ordered; for were they to set off, when first the testes and ovaria begin to grow tumid, they must waste much time here unnecessarily, and indeed arrive at too early a period to find a supply of food. Very little time is lost after their arrival, before they form their connubial alliances.* The business of nesting then begins; and as a convincing proof that nesting is the chief cause of their errand here, this, and its natural consequences, occupy their attention from the time of their coming to the day of their departure. This is illustrated by the dispatch which some of them make in performing the object of their mission. The cuckoo

its digestive powers. While the swift is feeding on small beetles that have hard crustaceous wings, and whose habitations are the air, its nestlings are fed in their early state with gnats. The sparrow, a granivorous bird, feeds its young for several days after they are hatched, with the softest insects only, now and then introducing a little coarse sand, smooth on the surface, to inure the stomach, as I suppose, to bear the same kind of substances in a more rugged state, which will shortly be required.

* Should a fatal accident befal either the male or female bird after this alliance is newly formed, no time is lost in unavailing sorrow, nor any great nicety shown in forming a new connection, as the following little history will evince. A pair of magpies began to build their nest in a gentleman's garden at Burbage, in Wiltshire. Disliking their familiarity, he shot one of them from an ambush made for the purpose. The next day there were again a pair going on with the work. One of these was also shot. The loss was not long in repairing, for the day following the pair were again complete, when another fell a victim to the gun. Thus the gentleman went on destroying one of them daily until he had killed seven; but all to no purpose—the remaining magpie soon found another mate. The nest was finished, and young ones were produced, which were suffered to fly. This is an extraordinary fact.—It seems to show that nature has a reserve of birds in an unconnected state, immediately ready to repair losses. Were the whole to pair at once, the circumjacent country might be insufficient to furnish food for the immense number of young ones that must burst forth at the same time.

finishes this business in a shorter space of time than any other bird, but as he deviates so widely from the common laws of the feathered society, I shall select the swift, as a better example for pointing out the fact. The swift shows himself here about the beginning of May (sometimes a few stragglers appear earlier) and by the beginning of August he has completely reared his young ones, which seldom consist of more than two. At once the old birds and their family take their leave and are seen no more for that season. Now his farther residence cannot be rendered unpleasant by any disagreeable change in the temperature of the air, or from a scarcity of his common food, which at this time abounds in the greatest plenty. This circumstance of the early departure of the swift, without a more apparent cause, seems to have excited much astonishment and perplexity in the mind of that attentive and ingenious naturalist, the late Mr. WHITE, of Selborne. Speaking of the swift, (Letter XXI. page 184), he says, " But in nothing are swifts more singular than in " their early retreat. They retire, as to the main body of " them, by the tenth of August, and sometimes a few days " sooner; and every straggler invariably withdraws by the " twentieth, while their congeners all of them stay till the " beginning of October, many of them all through that " month, and some occasionally to the beginning of Novem- " ber. This early retreat is mysterious and wonderful, since " that time is often the sweetest season of the year. But " what is more extraordinary, they begin to retire still ear- " lier in the most southerly parts of Andalusia, where they " can be no ways influenced by any defect of heat; or as " one might suppose, defect of food. Are they regulated in

" their motions with us by a failure of food, or by a propen-
" sity to moulting, or by a disposition to rest after so rapid
" a life, or by what? This is one of those incidents in Natural
" History that not only baffles our searches, but almost eludes our guesses!" Thus Mr. WHITE.

Now, should the principle I have laid down be admitted, namely, that these birds come here for scarcely any other purpose than to produce an offspring, and retreat when the task is finished, how easily will all circumstances be reconciled? and how little mysterious will those things appear which naturally seemed unaccountable, not only to the amiable author from whom the foregoing passage is taken, but also to others, who have written before on the same subject.

It is somewhat remarkable, that so sagacious a philosopher as the illustrious and learned RAY, who so clearly saw the object of migration in fishes, should not also have been led to a sight of it in birds. After making a very just observation respecting salmons, that quit the sea and ascend up rivers with no other view than to find a place of security for their spawn in the sand; he directly says again, adverting to birds, " What moves them to shift their quarters? You will
" say the disagreeableness of the air to the constitution of
" their bodies, or want of food."*

The spring migrating birds do not arrive here at first in very large numbers. It may be observed, that in the early part of April a few swallows may be seen; soon after these a few solitary martins, and as the month advances now and then a swift. On the walls of Berkeley Castle, martins build their nests in great numbers. I availed myself of their situ-

* RAY, on the Wisdom of God in the Creation. Part 1., page 128.

ation, and took several of them on the same night, the latter end of May. On dissection, the cause of their gradual and successive migrations appeared obvious, the testes and ovaria being in very different states of progressive forwardness. While one bird presented embryo eggs in the ovarium as large as peas, in another they were found no larger than hemp-seed. These were the extremes; for in the other birds there appeared all the intermediate stages, from the enlargement of the ovaria, sufficient to give the stimulus for migration, to the degree of forwardness just described. The same gradations in the state of the testes of the male corresponded with that of the ovaria in the females. This progressive arrival is not confined to the swallow tribe: all the birds that come early in the spring appear in the same gradual manner. I cannot help observing, that here the wise design of Providence is very conspicuous. Their appearance keeps pace with that of the insects which are to afford them food. If the numbers which flock in upon us in May, were to arrive in April, when only part of them appear, all must be insufficiently supplied, and many of course perish from a want of the needful succours; but by the middle of May, myriads of insects have produced eggs, and great numbers have either brought forth, or matured their progeny; and it may be remarked, there is still a greater increase of insect food by the time the young birds begin to require it. Swallows, on their first coming, feed principally upon gnats. These insects are called forth from their wintry retreats when the air is but moderately heated, 48 degrees of FAHRENHEIT's thermometer being sufficient to put them on the wing. It is in pursuit of them that we see, in cool weather, the

swallow incessantly skimming over the surface of ponds and brooks; and their thus early hovering over water has strengthened the idea of their having lately emerged from their watery abode, where they are supposed to have lain dormant during the winter. But they are driven by necessity to feed on the gnat. Like the swift and martin, their more favourite food is a small beetle of the scarabæus kind, which, on dissection, I have found in far greater abundance in their stomachs than any other insects.

The tumid state of the testes and ovaria sometimes comes on prematurely, and in the same manner sometimes subsides. When this happens, swallows and martins desert their nestlings, and leave them to perish in the nest. The economy of the animal seems to be regulated by some external impulse, which leads to a train of consequences. When this change in the testes and ovaria takes place, the bird becomes impelled by a stronger principle, that is, the desire of self preservation. This sometimes happens when they produce a very late hatch. A pair of martins hatched four broods of young ones in the house of a tradesman in this place in the year 1786. The latter brood was hatched in the early part of October. About the middle of the month the old birds went off, and left their young ones, about half fledged, to perish. The pair returned to the nest the 17th of May, 1787, and threw the skeletons out.

Thus scarcely a winter passes but we hear of a nest of robins, hedge-sparrows, and some others of the smaller birds. We have been informed by PENNANT, and it has been noticed also by others, that the cuckoo has been heard to give his song so early as the middle of February, two months sooner

than the usual time. The same deviation from the ordinary course of nature, which prematurely occasions the pairing of our domestic birds above-mentioned, proves the stimulus, I conceive, to certain unseasonable migrations, and accounts for the irregularity first noticed. The same argument is of course applicable to the premature appearance of any other migrating birds. The month of March sometimes affords us warm weather for several successive days. At this time I have often seen the snake basking under a hedge. The lizard too, has been invited from his cold retreat; but never could I see the swallow or the martin, although I have taken every opportunity of looking for them during the transient sunshine, and made diligent enquiries of others. At the further advancement of spring, often in April, when, from the long prevalence of north-easterly winds, the weather becomes unseasonably cold, and even frosty, swallows, martins, and other early migrators appear among us. But they soon experience the hardships of an inhospitable reception: the insects that should afford them food being still in a state of torpor in their wintry recesses, and unless called forth by some agreeable change in the air, the unfortunate birds perish for want of food. This I have known happen during an inclement spring, and have picked up starved martins under their nesting places, and willow wrens, which have perished under hedges, through a want of succours.

Unlike the migrating birds that winter with us, of which I shall speak in a subsequent part of this paper, the spring or summer birds do not possess the disposition to change the scene and seek a more genial clime, when this country is so overspread by frost as to deny them their common supplies.

This, I imagine, will admit of an easy explanation. The winter birds require nothing here but food and shelter. Our summer visitors come for more various and important purposes. Had they, like the former birds, been endowed with a disposition to wander on certain changes of the atmosphere, the great design of their migration, as it must have proved fatal to the business of incubation and the rearing of their young, would have been frustrated. It may be worthy of remark, that both the summer and winter migrating birds are, on their arrival here, well received by the domestic natives, and neither create quarrels nor excite fears. The redstart builds its nest in the same tree with the titmouse, and the redwing feeds peaceably in the same meadow with the starling.

I proceed now to make some observations on another kind of migration, directly opposite to the foregoing, namely, the return of the spring migrators to their respective *homes*.

The great disproportion in numbers between those species of birds which quit the country in summer, and those that leave it at the autumnal season, has led naturalists to lose sight of the early migrators, and to confine their reflections on the subject to the late ones only. Hence the common observation, that they are *all* driven off through a failure of food, or a cold temperature of the air. But seeing that many of them disappear in the summer season, when food is placed before them in the greatest plenty, we must seek for some other cause. If we examine what is now going forward in the animal economy, dissection will point out a change in the testes and ovaria, the very opposite to that which took place

in the spring. These parts now begin to shrink,* the disposition for raising a farther progeny ceases, and the nuptial knot is dissolved. What inducement have they to stay longer in that country where, I think, it clearly appears their chief object is to multiply their species? This being now effected, they retire to different parts of the globe, doubtless better suited to their general dispositions and wants, when disengaged from parental duties. In many of the migrating species, indeed in the far greater number, the disposition for farther incubation, and the season for their procuring a farther supply of insect food, cease at the same time. It is pretty evident from the habits of the cuckoo and the swift, that quit us in the summer as soon as their nesting is at an end, that swallows, martins, and those birds that disappear in the autumn, would depart at an earlier season, even though their supplies were to continue, if the rearing of their young were perfected. Indeed, as has been before observed, so strong does this propensity now and then appear, that it overcomes even the obligation of rearing their young when hatched late in the season, and they are sometimes left in a callow state to perish in their nests. This premature departure, probably arises from a reverse of that stimulus which occasions the too early migration of the spring birds, as has been noticed in a former part of this essay, namely, a change which takes place in organization.

One of the most singular occurrences in the history of migration, is the mode of departure of the young birds from the country where they were produced. It may be conceived

* I examined a female cuckoo the first week in July, and found the oviduct shrivelled, and all the eggs disposed of.

that the bird which had once crossed the Atlantic, or any other ocean, might have something impressed upon it that should prove an inducement to its return; but this cannot be an incitement to the young one. The identical bird, which but a few weeks before burst from the shell, now unerringly finds, without any apparent guide, a track that leads it safely to the place of its destination, perhaps in many instances over the widest oceans.

It is well known, that those birds which incubate several times in the course of one summer, forsake their first broods when they no longer require their protection: and being now alienated, they cannot, in their parents, find the guides that conduct their course. As swallows and martins congregate* prior to their departure from us, it may be said that their young, though discarded, may mingle with the common flock, and in this particular instance I am ready to admit that it is probable they may do so; but there are many migrating birds that never either associate with swallows and martins, or join together in flocks, as the nightingale, redstart, and indeed the far greater number. As a striking proof that the parent bird cannot possibly be the guide, in one instance at least, we may point out the cuckoo, whose offspring finds a distant shore in perfect safety, although it could never know the parent to whom it was indebted for existence, and though

* Swallows and martins congregate on the sunny sides of buildings for the sake of warmth, and not, as it is generally supposed, to hold a kind of consultation previous to their final departure. In the wet summer of 1821, when the air was unusually chilled by the long continued rains, they were observed to assemble, during some intervals of sunshine, for several successive mornings, as early as the middle of July; and in the present year (1822), I remarked the same on some mornings that were unseasonably cold about the middle of August.

its existence in numberless instances must have taken place even after the departure of the parent. For the old cuckoos invariably leave us early in July, when many of their eggs are yet unhatched in the nests of those small birds to whose fostering care they are entrusted. Compared with quadrupeds, and some other animals, birds may be considered as acquiring the adult state at an early period, and the young bird, at the time of its leaving us, may be looked upon as possessing power equal to the old one in procuring food, velocity of flight, &c. The parent bird, from having lost that stimulus by the subsiding of the testes and ovaria, which urged it to incubation and detained it here, is now reduced to a condition similar to that of its offspring, both falling into the same habits, and remaining in the same state with respect to organization, until the returning calls of nature urge them to quit that country again to which they are *now* about to depart.

II.

Winter Birds of Passage.

"We have, 'tis hoped, made it pretty evident that summer "birds of passage come to and depart from us at certain sea- "sons of the year, merely for the sake of a more agreeable "degree of warmth, and a greater plenty of food; both which "advantages they procure by an alternate change of climate; "but the migration of winter birds of passage, and particu- "larly of fieldfares and redwings, is much more difficult to "be accounted for, there being no such apparent necessity "either on the score of food or climate, for their departure "from us."

Mr. CATESBY, Phil. Trans. No. 483.

The winter birds of passage, as they are commonly called, begin to take their leave of us about the same time that the spring migrators are taking wing to pay us their annual visit. As the latter appear among us in gradual succession, so in like manner the former disappear. They are both actuated by the same impulse, the former in leaving, and the latter in coming to this country, namely, the enlarged state of the testes and ovarium. As soon as the stimulus becomes sufficiently felt, they quit their homes in quest of a country better suited to their intended purpose than their own.

That a want of food cannot be the inducement, must be obvious to the slightest observer. When the redwing and fieldfare quit this country, it abounds with that food which they prefer to any other; and at this time they are in the finest condition; the redwings often enjoying their plenty by assembling together on trees, and there uniting their feeble voices, make no unpleasant song.*

The winter birds (the females at least) may be said to seek a better accommodation, upon the same principle as the poor woman who quits her cottage for the comforts of a Lying-in Hospital. Here, both herself and suckling are for a while supported in that peculiar way which their situations at that time require. For this reason, conceiving it will tend to lessen confusion, I choose to call this country the *home* of the winter birds (though not natives), and the countries from whence they come, the home of the summer birds, looking

* The same thing happens through the winter, whenever the weather has long continued so mild as to allow them plenty of insect food. The starling, and some other birds which have a short note and weak voice, unites with its companions in the spring, and forms a similar concert.

upon the latter merely as visitors; and let it be recollected how soon the visits of some of them are paid; for being governed by an unerring principle, they stay to accomplish one great design only, that of rearing their young, and then return.

The countries to which many of the winter birds retire not being very far distant, are better known to us than those to which the summer birds migrate; but I must forbear entering into an enquiry upon this subject, as remote from the design of this paper; and indeed it may be thought I have already, in some instances, digressed too widely from my original purpose.

The migration of the winter birds is less distinctly marked than that of the spring migrators. The snipe, the wild-duck, the wood-pigeon, breed here in considerable numbers; the two latter indeed, particularly the wood-pigeon, are so numerous in summer, that we should hardly be reminded of the migration, did they not pour in upon us in such immense flocks in the winter. They are accompanied by the stock-dove, which I have never known to breed here. The home-bred wild-ducks are easily distinguished by the men who attend decoy-pools, by the meanness of their plumage, when compared to the brightness of those birds which come from abroad. The former are taken some weeks earlier than the latter.

The most conspicuous among the winter migrating birds are the redwings and fieldfares. These are regular and uniform in their appearance and disappearance, and I believe never risk the trial of incubation here, at least I never could hear of a single instance. The food of these birds has in the

works of every naturalist I have ever had access to, who had written on the subject, been pointed out as the haw, the fruit of the white thorn.*

This is an error that has long wanted a correction, for in open weather they take them in very scanty quantities, and feed on the ground on worms and such insects as they can find. Although repeated examinations of the contents of the stomach have afforded the best proof of this, yet there is scarcely any need of calling in its aid in the present instance, as we may be convinced of the fact, by seeing them in flocks feeding on the ground in open fields and meadows. I do not deny their taking the haw and other vegetable food from the hedges, but they do it in so sparing a way, that I have remarked, that red wings and fieldfares die through hunger during the long continuance of frosty weather, while the haws on the hedges were by no means deficient. The occasional departure of these and some other winter birds during a long continued frost, must be very obvious. The greater number disappear soon after its commencement, if it sets in very severely: some few are always left behind and are soon starved, if not fortunately relieved by a thaw. Those that are driven to this necessitous migration, probably pursue a track that quickly leads them out of the reach of frost. Of these flights I shall produce instances, which render it probable that they are able even to out-strip its course.

The approach of intense frost is often to a certainty made known to us by the appearance of a numerous tribe of water-

* "The principal food of these birds while with us, is the fruit of the white "thorn, or haws, which hang on our hedges in winter in prodigious plenty."
Phil. Trans. Vol. XLIV. p. 435.

birds, some of which are rare, and seldom show themselves here on any other occasion. We commonly see them three or four days prior to the setting in of very severe frosty weather. This was manifest at the latter end of the year 1794, at the coming on of the severe season that ensued. In the river Severn, about a mile and a half to the westward of this place, were seen and taken many species of water-birds, that generally confine themselves to the more northern regions. Far more pleasant is it to see during the continuance of hard frost, the return of those birds which had left us at the beginning. These are pleasant omens, and most certainly forebode a thaw. The following example shows how soon they catch the first opportunity of again seeking those countries from which they were so lately driven by necessity. The day preceding the thaw, the frost being then intense, a gentleman who was shooting observed a large flock of fieldfares, birds that are extremely common here in milder weather. They were as much untamed as if no frost had appeared in our island. He had the good fortune to shoot one of them, which was brought to me. I found it as fat and plump, and in every respect in as good condition, as if it had remained here undisturbed, and had found provision in the greatest plenty, though it was without a particle of food in its stomach. Its last meal was digested; and the frost still remaining, it could find no food for its present support. Now it is very obvious that this bird, and its companions, must have taken a long flight, and probably in a very short space of time; for the intense frost, that was of such duration and so severely felt here, extended far into the more southern parts of Europe, beyond which they must have resorted for that

plenty of food which gave plumpness to the one I examined, and doubtless to the whole flock, from their appearing so wild and vigorous. It clearly appears, that in their flight they exceeded the progress of the thaw, as the northern birds did that of the frost. This thaw, though it was again succeeded by frost, came on very rapidly, and occasioned, by the sudden melting of the snow, those destructive inundations through the kingdom, that will not readily be forgotten.

This account of the fieldfare sets the fact of migration, though from an accidental cause, beyond the reach of doubt. There was no support for it here; the ground was deeply covered with snow, and the intense frost, by its long duration, had destroyed every thing that could afford it succour; it must, therefore, have taken a long flight from this country, and returned to it again at the approach of temperate weather.

Having already made so many digressions, I cannot add another without offering an apology; but as there is something so like providential design in the order in which the song birds chaunt out their warblings during a long summers day, I trust the Society will pardon my laying before them the following observations on the subject.

We must observe, that nature never gives one property *only*, to the same individual substance. Through every gradation from the clod we tread upon to the glorious sun which animates the whole terrestrial system, we may find a vast variety of purposes for which the same body was created. If we look on the simplest vegetable, or the reptile it supports, how various, yet how important in the economy of nature, are the offices they are intended to perform! The

bird, I have said, is directed to this island at a certain season of the year to produce and rear its young. This appears to be the grand intention which nature has in view; but in consequence of the observation just made, its presence here may answer many secondary purposes; among these I shall notice the following. The beneficent Author of nature seems to spare no pains in cheering the heart of man with every thing that is delightful in the summer season. We may be indulged with the company of these visitors, perhaps, to heighten, by the novelty of their appearance, and pleasing variety of their notes, the native scenes. How sweetly, at the return of spring, do the notes of the cuckoo first burst upon the ear; and what apathy must that soul possess, that does not feel a soft emotion at the song of the nightingale, (surely it must be "fit for treasons, stratagems, and spoils") and how wisely is it contrived that a general stillness should prevail while this heavenly bird is pouring forth its plaintive and melodious strains,—strains that so sweetly accord with the evening hour!—Some of our foreign visitors, it may be said, are inharmonious minstrels, and rather disturb than aid the general concert. In the midst of a soft warm summer's day, when the martin is gently floating on the air, not only pleasing us with the peculiar delicacy of its note, but with the elegance of its meandering; when the blackcap is vying with the goldfinch, and the linnet with the woodlark, a dozen swifts rush from some neighbouring battlement, and set up a most discordant screaming. Yet all is perfect. The interruption is of short duration, and without it, the long continued warbling of the softer singing birds would pall and tire the listening ear with excess of melody, as the exhila-

rating beams of the sun, were they not at intervals intercepted by clouds, would rob the heart of the gaiety they for a while inspire, and sink it into languor. There is a perfect consistency in the order in which nature seems to have directed the singing birds to fill up the day with their pleasing harmony. To an observer of those divine laws which harmonize the general order of things, there appears a design in the arrangement of this sylvan minstrelsy. It is not in the haunted meadow, nor frequented field, we are to expect the gratification of indulging ourselves in this pleasing speculation to its full extent; we must seek for it in the park, the forest, or some sequestered dell, half enclosed by the coppice or the wood.

First the robin, and not the lark, as has been generally imagined, as soon as twilight has drawn the imperceptible line between night and day, begins his lonely song. How sweetly does this harmonize with the soft dawning of day! He goes on till the twinkling sun-beams begin to tell him his notes no longer accord with the rising scene. Up starts the lark, and with him a variety of sprightly songsters, whose lively notes are in perfect correspondence with the gaiety of the morning. The general warbling continues, with now and then an interruption, for reasons before assigned, by the transient croak of the raven, the screaming of the jay and the swift, or the pert chattering of the daw. The nightingale, unwearied by the vocal exertions of the night, withdraws not proudly by day from his inferiors in song, but joins them in the general harmony. The thrush is wisely placed on the summit of some lofty tree, that its loud and piercing notes may be softened by distance before they reach the ear, while

the mellow black-bird seeks the inferior branches. Should the sun, having been eclipsed with a cloud, shine forth with fresh effulgence, how frequently we see the goldfinch perch on some blossomed bough, and hear his song poured forth in a strain peculiarly energetic; much more sonorous and lively now than at any other time; while the sun, full shining on his beautiful plumes, displays his golden wings and crimson crest to charming advantage. The notes of the cuckoo blend with this cheering concert in a perfectly pleasing manner, and, for a short time, are highly grateful to the ear; but, sweet as this singular song is, it would tire by its uniformity, were it not given in so transient a manner. At length, evening advances—the performers gradually retire, and the concert softly dies away. The sun is seen no more. The robin again sets up his twilight song, till the still more serene hour of night sends him to the bower to rest. And now to close the scene in full and perfect harmony, no sooner is the voice of the robin hushed, and night again spreads a gloom over the horizon, than the owl sends forth his slow and solemn tones. They are more than plaintive, and less than melancholy, and tend to inspire the imagination with a train of contemplations well adapted to the serious hour. Thus we see that birds, the subject of my present enquiry, bear no inconsiderable share in harmonizing some of the most beautiful and interesting scenes in nature.

But let me here remark—how ill would the singing of birds agree with the general appearance of winter—the leafless tree,—the snowy mead,—the frozen rivulet! Yet it must be noticed here, that these rigors, in the midst of this dreary season, are sometimes suddenly softened, and a temperate

state of the air succeeds. We are then so enlivened by the transition from extreme cold, to a temperature comparatively warm, that we can listen with pleasure to the enfeebled notes of some of the song birds. How admirable the contrivance! There are several birds which have no continued flow of notes, but a kind of chirp only, consisting of some variety of sounds. During a long continued frost, the earth affords many of the feathered tribe so scanty an allowance, that they preserve themselves with difficulty from perishing; a sudden thaw takes place,—plenty at once appears, and every crop is filled. Tis then we see the redwing and starling assemble in large flocks among elms and apple trees, and, by uniting their voices, produce a song not in the least discordant, but, on the contrary, extremely harmonious. At this time the thrush, and even the blackbird, will occasionally afford us a transient song; but it may be observed, that the notes of these birds are rather to be considered as plaintive, than lively. The lark, too, will sometimes mount in the air, beguiled, as it were, by the faint rays of a wintery sun, but his notes are then as poor and feeble as the beams that call him forth. The robin indeed cheers us with his song during the whole of the winter, unless driven off by intense frost, and is the only bird I know, whose notes, at this time, would fully accord with our feelings, so perfectly do they mingle with the surrounding order of things. The goldfinch, were he now to open his full song upon us, would be as appalling as the tones of the owl in the midst of a fine summer's day.

III.

Mr. JOHN HUNTER, my late valued friend, and honoured preceptor, under whose roof I first caught a gleam of that light which so successfully conducted him through the obscure paths of nature, first demonstrated the different sizes of the testes of birds at different seasons of the year. On a farther investigation of this subject, a fact presented itself to me, which may not be unworthy of the attention of this Society, and, as it is in some measure connected with the preceding observations, I have taken the liberty of annexing it.

In those birds that remain but a short time paired with the female, there appears a vast disproportion in the size of the testes, compared with those that live in the connubial state much longer. The cuckoo and the swift point out the fact most obviously. The common brown wren, which remains united with its female from the early part of spring, until the autumn, exhibits testes very far exceeding in size, either those of the cuckoo or the swift. The cuckoo, although a polygamist, may here be considered in the same point of view as the birds that pair. The time which he devotes to the female being so very short, more so indeed by some weeks than even that of the swift, the testes are formed extremely small in proportion to the size of the bird. I never saw them exceed in size the common vetch, while those of the wren were full as large as a common sized garden pea. The medium weight of the cuckoo is about four ounces and a half, that of the wren but little more than three drachms.*

* Ornithologists might easily have given us the weight of a bird with greater precision, by divesting the stomach of its contents, previous to the bird being

The testes of the swift, which assume a singular oblong shape, somewhat exceed the cuckoo's in bulk, though not so large as those of the wren. I have selected the wren as an example for this comparison, on account of its diminutive size. The testes of all those birds which are capable of producing young more than once in the breeding season, become tumid, as far as I have seen, in the same proportion as those of the wren.

As there are many birds, which, if unmolested, produce but one nest of young ones in the course of the season, it may be asked, why nature should cause as great an enlargement of the testes in these, as those which breed more than once; and why they should exceed in bulk those of the cuckoo or the swift? The answer, I presume, is obvious. Should any ill accident befall the nestlings of the swift when advancing to maturity, the injury would be irreparable, the parent bird being destined to quit the country before another offspring could be reared. The cuckoo is in the same predicament; but the wide dispersion of its young ones, (being placed singly in the nests of other birds), gives them such security as almost to preclude the possibility of their general destruction.* But it is not so with those birds which make a longer stay; should similar accidents befall them, they can repair their losses. Nature, as long as incubation could serve their

weighed. For example: how very different must the weight of the owl be, which, in its nocturnal flights, had the luck to pick up a mole or two, compared with that which had met with opposite fortune; or of the falcon, that had picked the bones of a leveret, or of the one that was killed with an empty stomach.

* May not this be offered as another reason, why its eggs and young ones are entrusted to the fostering care of so great a variety of birds? It could not have time, during its short stay, to rear so large a progeny; and by no other means could it have placed its numerous brood so much out of the way of danger.

purposes, would keep an accumulation of the proper powers in store, which, in the case of the cuckoo and swift, would be entirely useless.

Whether there be a regular gradation in the size of the testes (that of the bird itself being considered), throughout the whole race, in proportion to the time taken up in pairing, I cannot determine, not having had an opportunity of subjecting the matter to a full investigation. However, I thought the fact already shown of sufficient importance in natural history, to be worthy of communication, as it forms a kind of sequel to Mr. HUNTER's paper on the subject.

With due deference to the late Dr. DARWIN, I am inclined to think that the opinion he set forth respecting the pairing of cuckoos, was taken up hastily, and that the birds which his friend saw were not cuckoos feeding their nestlings, but goat-suckers, whose mode of nesting corresponds with the relation given, and whose appearance might be mistaken for them by one not perfectly conversant with the plumage and the general appearance of cuckoos when on the wing. Is it probable that the cuckoo, which is invariably a polygamist, and never pairs, nests, or incubates in this part of the island, should fall into opposite habits in another part?

To recapitulate the substance of my observations. I have first adduced some arguments in support of migration, the fact itself not being generally admitted by naturalists of celebrity, and also against the hypothesis of a state of torpor, or what may be termed the hybernating system. I have represented that the swallow tribe, and many other birds that absent themselves at stated periods, return annually

to the same spot to build their nests; and at the same time that any inference drawn from this fact in support of a state of torpor, would be fallacious upon physiological principles. That certain periodical changes of the testes and ovaria, are the inciting causes of migration. I have stated many facts, hitherto, I believe, unnoticed, chiefly with respect to the *cause* which excites the migrating bird, at certain seasons of the year, to quit one country for another, (viz.) the enlargement of the testes in the male, and ovaria in the female, and the need of a country where they can for a while be better accommodated with succours for their infant brood, than in that from which they depart. It is also attempted to be shown, that their departure from this country is not in consequence of any disagreeable change in the temperature of the air, or from a scarcity of their common food, but the result of the accomplishment of their errand, *i. e.* the incubation, and rearing of their young, and the detumescence of the testes and ovaria. That successive arrivals of migrating birds are attributable to the progressive developement of the generative system in the male and female: that progressive developements are wise provisions of nature; that premature arrivals and departures are frequently to be accounted for on the same principle; that the departure of the spring migrators is owing to a change in the testes and ovaria, the very opposite to that which took place in the spring; that the departure of the young birds is not guided by the parent, but the result of an unknown principle.

In the second part of this paper, some observations are made on the winter birds of passage; that they quit their

homes (this country) in spring, in quest of a country better suited to their intended purpose than their own; that they are actuated by the same impulse in quitting this country, that causes the spring birds to come to it, and that want of food cannot be the inducement; that the emigration of the winter birds is less complete than that of the others (the spring migrators); that some species breed here, especially the wild-duck and wood-pigeon; that the redwings and fieldfares are the most regular and uniform in their appearance and disappearance, and most probably never risk the trial of incubation here;* that they quit the country *temporarily* in severe and long continued frost through want of food, and return to it again at the approach of more temperate weather; that the arrival of water-birds forebodes the approach of intense frost, the usual return of the winter-birds, a thaw; that examinations of the latter prove them to have taken long flights before their return, and sets the fact of temporary migration beyond the reach of doubt.

I have then made a digression, and introduced some observations on the singing of birds; and in a third part, given some additional particulars respecting the different sizes of the generative organs of birds, as they appear at different seasons of the year.

* I must be understood by the word "here," to mean that part of Gloucestershire under my own observation.

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